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This booklet was prepared to assist teachers of elementary school mathematics in the effective use of the basic and supplementary state-adopted textbooks. Within each grade level, four categories of basic skills and understandings were developed. These were (1) number systems and numeration systems, (2) fundamental operations, (3) measurement, and (4) geometry. In some grade levels, geometry was omitted due to lack of textbook materials. Prerequisites to the skills and understandings are listed, as well as the pages where those topics would be introduced, reviewed, and/or extended. The topics listed represent only a minimum program in elementary school mathematics. (RR)

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**GUIDELINES
FOR THE USE OF
BASIC AND SUPPLEMENTARY
MATHEMATICS TEXTBOOKS
IN THE
ELEMENTARY SCHOOLS**

**U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION**

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**LOS ANGELES CITY SCHOOLS
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FOREWORD

The material in this Instructional Bulletin has been prepared to assist teachers in the effective use of the basic and supplementary state-adopted textbooks in elementary school mathematics.

Charts have been prepared for each grade level B1--A6, which list in four categories the basic skills and understandings from the Course of Study for Elementary Schools, Los Angeles City Schools Publication No. 375, 1964 Revision. These are:

**Number Systems and Numeration Systems
Fundamental Operations
Measurement
Geometry**

The skills and understandings listed on the charts do not represent the entire elementary school mathematics program as found in the Course of Study for Elementary Schools, but, rather, a minimum program for most pupils at each grade level. With this framework as a guide, the teacher may then plan additional lessons to develop all facets of the instructional program in mathematics, as outlined in the Course of Study for Elementary Schools.

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INTRODUCTION

On the following pages, each chart consists of three parts: prerequisites; skills and understandings; and a paged reference as to where these skills are either introduced, reviewed, or extended.

The prerequisite column identifies experiences, skills, or understandings that should be presented, either prior to or as a part of the lessons outlined in the textbook. It is generally assumed that pupils will be familiar with the material of the preceding grade level before attempting to work with a skill at a new grade level.

The second column lists the basic skills and understandings that are found in the Course of Study for a particular grade level. The word "skills" involves reading and writing numerals, as well as the development of facility in computation. The word "understandings" refers to the generalizations and principles that are found in a mathematics program which are an outgrowth of experiences in working with and understanding numbers of all kinds.

The third column lists the pages where the particular skill is first introduced to the pupil in an elementary school. The teacher should note that a reference in this column indicates something new to be learned. If the column is blank, then most of the textbook material is a review or extension of what has been taught previously.

The fourth column lists the pages of additional material that can be used for review or drill of a particular skill or understanding. A second function of this section is the listing of pages that extend the skills or understandings that have been taught previously. Problems of increasing complexity are included in this category.

The references listed do not constitute all of the pages or lessons that are in the textbooks, nor is it intended that pupils should be required to complete all of the pages that are listed. The teacher assigns or deletes particular lessons, according to the needs of the pupils.

In some sections there are specific skills or understandings that are mentioned, but no pages are listed. Such skills or understandings have been listed to alert the teacher to the fact that they should be emphasized as a part of the instructional program.

Some topics have been marked as optional for a particular grade level. These are to be taught only to those pupils that show a readiness for these skills and understandings. Optional topics may be considered as basic topics at the next grade level. The listing of optional topics reduces the content of the instructional program for most pupils.

Problem solving lessons have been included in the review and/or extension section. This is an important phase of the instructional program and should receive regular attention prior to and following the development of the related computational skills.

In some grade levels, the geometry category has been left out, since there was not adequate material in the textbook for that grade level. It is suggested that the teacher review the geometry material from the previous grade when this omission occurs.

The basic and supplementary textbooks used as references in this bulletin refer to the pupil editions of the following books.

- Grade 1:** Greater Cleveland Mathematics Program, Book 1 (Basic)
Modern Arithmetic Through Discovery, Book 1 (Supplementary)
- Grade 2:** Greater Cleveland Mathematics Program, Book 2 (Basic)
Modern Arithmetic Through Discovery, Book 2 (Supplementary)
- Grade 3:** Greater Cleveland Mathematics Program, Book 3 (Basic)
Modern Arithmetic Through Discovery, Book 3 (Supplementary # 1)
Math Workshop for Children, Level C (Supplementary # 2)
- Grade 4:** Modern Arithmetic Through Discovery, Book 4 (Basic)
Math Workshop for Children, Level D (Supplementary)
- Grade 5:** Modern Arithmetic Through Discovery, Book 5 (Basic)
Math Workshop for Children, Level E (Supplementary)
- Grade 6:** Modern Arithmetic Through Discovery, Book 6 (Basic)
Math Workshop for Children, Level F (Supplementary)

REFERENCE CHARTS, GRADE B1

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	MATHEMATICAL UNDERSTANDINGS				
Pupils should have experiences with	The meaning of whole numbers 1-9	5, 7, 11, 17, 21, 23, 31, 37, 43, 47, 49	1, 4	6, 8, 10, 12, 14, 18, 19, 22, 24, 32, 36, 38,	11, 14, 15, 16
- rote counting to develop number names					
- matching objects in one-to-one correspondence	10	59	18	60, 61, 62	
- recognizing sets of objects	0	67	3	68, 69, 72	
*11-50		121, 144, 145	18, 25	120, 122, 143, 146	25, 37
Many names for a number		9, 13, 19, 23, 28, 35, 39, 47, 53, 61	70		
Ordinal numbers		73, 75	17	74, 76	
* Place value in ten's place		117, 144		122, 124, 146, 156, 157, 158	
* Expanded notation to rename numbers: 11-50					
Comparing numbers		25, 26		63, 64, 167, 168	

NUMBER SYSTEMS AND NUMERATION SYSTEMS

*** OPTIONAL TOPICS FOR THIS GRADE**

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have	MATHEMATICAL SKILLS				
- motor coordination sufficiently developed for successful writing of numerals	Reads and writes numerals 1-9	6, 8, 11, 12, 18, 22, 24, 32, 38, 44, 50	2, 3, 5, 6, 8, 9	12, 13, 14, 15, 16, 20, 27, 28, 33, 34, 39, 40, 41, 42, 45, 46, 48, 51, 52, 54, 57, 58, 69	7, 12, 16
- an understanding of the meaning of each number prior to the introduction of the numeral		0	68	10	
- experiences in rote counting to learn the number names	*11-50	10	117	118, 119, 120	
		121, 144, 156	25	120, 123, 124, 143, 146, 158	37, 44, 45, 53, 104, 129
	Counts by ones to 50	57, 123, 158	1	58	11, 12, 13, 124, 129
	COMPUTATIONAL SKILLS				
Pupils should have experiences with	Addition facts with sums through 10	77, 78, 81, 95, 105, 106, 125, 135, 147, 159, 177	13, 20	79, 80, 81, 82, 83, 96, 97, 98, 111, 126, 136, 139, 148, 160, 162, 163, 169, 170, 178, 181, 182, 183,	14, 15, 21, 22, 23, 24, 40, 41, 42, 43, 68, 71, 72, 74, 75, 76, 77, 84, 86, 88, 95, 99, 100, 110, 111, 117, 120, 124, 131, 144
	Combining and separating sets of objects				
	writing the numerals				
	understanding the meaning of the numbers 0-9				

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension
		BASIC	SUPPL.	
	COMPUTATIONAL SKILLS (Cont.)			
	Subtraction facts with minuends through 10	85, 86, 99, 112, 150, 162, 186	27, 28, 29	88, 89, 90, 91, 92, 128, 138, 169, 170, 183
				68, 69, 74, 75, 76, 77, 86, 88, 95, 96, 97, 99, 100, 110, 111, 118, 121, 124, 131, 144
	Addition with three addends, no regrouping (carrying)	133	89	134, 141, 142, 153, 154, 171, 172
	MATHEMATICAL UNDERSTANDINGS			
	Addition is commutative	78, 125, 131, 147, 159	84	79, 80, 81, 83, 84, 126, 132, 148, 151, 152, 166, 181
	Pupils should understand			93, 94, 100, 101, 102, 103, 104, 108, 109, 110, 129, 130, 137, 149, 151, 152, 164, 166, 179
	- addition as a combining operation			
	- subtraction as a separating operation			
	Function of zero in addition and subtraction			115, 116

FUNDAMENTAL OPERATIONS

GRADE B1

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have experiences involving arbitrary units of measurement prior to the introduction of standard units of measurement.	MATHEMATICAL UNDERSTANDINGS Measurement: liquid Measurement: linear Measurement: time Money Values	55 56 91 48, 79 78, 79			
	MATHEMATICAL UNDERSTANDINGS Recognition of familiar shapes			73	
	Pupils should have perceptual experiences involving: - likenesses - differences - repeated patterns				

REFERENCE CHARTS , GRADE A1

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have experiences with:					
- rote counting to develop number names	The meaning of whole numbers: 11-50	121, 144, 145	18, 25	120, 122, 143, 146	185-190, 302
- recognizing sets of objects grouped by tens	50-99	173, 174, 176	18, 19, 26, 37,	25, 301-304, 38, 309-312	
- comparing sets of objects	Place value in ten's place	185-190	18, 19, 30, 31,	25, 301-304, 37, 312	
	*Place value in hundred's place	325	114, 115		125, 126
	Expanded notation to rename numbers 11-99		185-188 301-304		
	Awareness of odd and even numbers		329, 330		
	The meaning of rational numbers one-half	297, 298	47, 124		136, 141
	one-third	300			
	one-fourth	299			
	MATHEMATICAL SKILLS				
	Counts by ones to 100		18, 117		19, 26, 30
	Reads and writes numerals through 50	121, 144, 156, 158, 301		186, 188	5-10, 12, 44, 104, 129
	51-99	173-175, 309, 310	25, 26, 45, 46	30, 325-327, 328	31, 39, 46, 53, 54, 103, 139
	Compares numbers using <, >, =				204, 284

NUMBER SYSTEMS AND NUMERATION SYSTEMS

- experiences writing the numerals 0-9
- an understanding of the meaning of each number prior to the introduction of the numeral
- oral experiences using the number names

*** OPTIONAL TOPICS FOR THIS GRADE**

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	MATHEMATICAL SKILLS (Cont.)				
* Skip counts by twos to 50	329, 330				
* Skip counts by fives to 100	331, 332				
skip counts by tens to 100	327	25, 26	328		
	COMPUTATIONAL SKILLS				
Pupils should have experiences with	Addition facts with sums 11 through 18	227, 231, 243, 249, 273	228, 229, 230, 232, 233, 234, 235, 236,		
- combining and separating sets of objects		279, 283	244, 245,		
- addition and subtraction facts involving sums of 10 or less			246, 247, 248, 250, 251, 252, 253, 254, 274, 275, 276, 280,		
- writing the numerals 0-19			281, 282, 287, 289, 290		
	Subtraction facts with minuends 11 through 18	205, 206, 237, 239, 255, 257, 277, 283	209, 238, 240, 256, 258, 278, 289, 290		
- understanding the meaning of numbers beyond ten					
- counting from 10-20					
- sequence of the numbers from 0-20					
	Addition, one-digit addend and a two-digit addend (no regrouping or carrying)	191, 192, 305	193, 194, 195, 196, 201, 203, 212, 306		
	Subtraction, one-digit numeral from a two-digit numeral (no regrouping or carrying)	205, 206	209, 210, 211, 212, 307, 308		

FUNDAMENTAL OPERATIONS

Prerequisites	Skills and Understandings		Introduction		Review and/or Extension	
	BASIC	SUPPL.	BASIC	SUPPL.	BASIC	SUPPL.
COMPUTATIONAL SKILLS (Cont.)						
Addition, two-digit addends, (no regrouping or carrying)	313, 315	61, 62, 81	314, 316, 317, 318, 324	83, 92, 101, 112, 122, 133		
Subtraction, two-digit numeral from a two-digit numeral (no regrouping or carrying)	320, 321	66, 67	322, 323, 324	83, 93, 101, 112, 122, 133		
= = = = =						
MATHEMATICAL UNDERSTANDINGS						
- Addition and subtraction are inverse operations	207, 259, 285, 319	74, 75, 84, 85	208, 241, 242, 260, 286	95, 96, 97		
- Addition is commutative		74, 75,		95, 96, 97		
- Addition is associative		84, 85				
	89	291	90			
MATHEMATICAL UNDERSTANDINGS						
* Measurement: liquid	295			102		
Measurement: time	261, 263	113, 135	262, 264, 265,			
Money values	213, 217, 221		266, 267			
Measurement: calendar	271, 272					
* Measurement: linear	293					
FUNDAMENTAL OPERATIONS						
Pupils should have experiences involving arbitrary units of measurement prior to the introduction of standard units of measurement.						
MEASUREMENT						

* OPTIONAL TOPICS FOR THIS GRADE

GRADE A1

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have perceptual experiences involving:	MATHEMATICAL UNDERSTANDINGS Recognition of familiar shapes				
<ul style="list-style-type: none"> - likenesses - differences - repeated patterns 	GEOMETRY				

REFERENCE CHARTS, GRADE B2

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension
		BASIC	SUPPL.	
Pupils should have experiences with:	MATHEMATICAL UNDERSTANDINGS			
- rote counting to develop number names	The meaning of whole numbers 0-99			
- using concrete materials to show place value	Place value in ten's place	6, 70, 72	4, 5, 11, 12	
- comparing sets of objects	Expanded notation to rename numbers 11-99	38, 70, 72, 110	4, 12, 19, 30, 31	
- the sequential order of the numbers in the decimal system of numeration	Ordinal numbers through tenth	38, 111, 114	10	
Pupils should have experiences writing the numerals 0-9	The meaning of rational numbers: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{3}$	61-68	27, 64	
Pupils should have experiences with the addition and subtraction operations involving sums of 10 or less	COUNTS BY ONES BEYOND 100	46	55, 56	
Pupils should have experiences with reading and writing two-digit numerals	Reads and writes numerals through 99	37, 69, 70, 71, 74, 109, 110, 111, 113	2, 3, 5, 11, 12, 13, 19, 20, 30	
Pupils should have experiences with reading and writing two-digit numerals (no regrouping or carrying)	ADDITION FACTS, SUMS THROUGH 18	1-5, 27, 75, 76-78, 83, 84, 85, 86, 91, 92, 99	6-9, 21, 37, 57, 66, 77, 88, 99, 105, 106	
Pupils should have experiences with reading and writing mathematical sentences	SUBTRACTION FACTS WITH MINUENDS THROUGH 18	9, 10, 11, 12, 79, 80, 87, 93	15-18, 22, 38, 66, 77, 88, 105, 106	
Pupils should have experiences with reading and writing mathematical sentences	ADDING A ONE-DIGIT NUMERAL TO A TWO-DIGIT NUMERAL (NO REGROUPING OR CARRYING)	39-45, 48, 49, 115, 116, 117, 118, 119	51, 52, 55, 121, 123, 125	
NUMBER SYSTEMS AND NUMERATION SYSTEMS	FUNDAMENTAL OPERATIONS			

GRADE B2

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	COMPUTATIONAL SKILLS (Cont.)				
	Adding two-digit addends	134, 135, 143	80, 81	127, 128, 131, 132, 133, 136, 139, 140, 141, 142	47, 61, 92
	Subtracting a two-digit addend from a two-digit addend	137	82, 83	130, 138, 145, 146, 147	39, 40, 47
	MATHEMATICAL UNDERSTANDINGS				
	Addition is commutative	6		19, 20, 21 103	21, 37, 57, 103
	Addition is associative			23, 24, 25, 26 103, 104	49, 50, 51
	Addition and subtraction are inverse operations			7, 8, 13, 14, 22, 53, 54, 81, 82, 88, 94, 98, 126, 129	23, 24, 25, 25, 26, 32, 33-35, 40, 48, 57, 58, 59, 66-68, 78, 88, 89, 93, 100, 103
	FUNDAMENTAL OPERATIONS				
	MEASUREMENT				
	Pupils should have experiences involving arbitrary units of measurement prior to the introduction of standard units of measurements.				
	Measurement: liquid			31, 33, 35, 36	53
	Measurement: calendar	155	41	153, 154, 156	28
	Measurement: time	159-170 173-178	42		
	Measurement: linear		29		
	Money values		63		14

GRADE B2

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	MATHEMATICAL UNDERSTANDINGS				
Pupils should have experiences in recognizing a circle, a triangle, a square, and a rectangle.	Recognition of familiar figures	54			
	GEOMETRY				

REFERENCE CHARTS, GRADE A2

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have:	MATHEMATICAL UNDERSTANDINGS				
- an understanding of place value	The meaning of whole numbers 0		3		
- an understanding of grouping by tens	100	241			
- the ability to count by ones to 100	101-999	244, 246	45, 46, 73, 74, 75, 97		
- an understanding of the "one more" concept as it relates to the decimal system of numeration	Expanded notation to rename numbers through 999	248			
= = = = =	Place value in ten's and hundred's place	241			
= = = = =	The meaning of fractional numbers			104, 131	
Pupils should have:	MATHEMATICAL SKILLS				
- an understanding of the repeated use of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 in writing the numerals to 99	Counts by ones, twos, fives, tens, hundreds		46, 128	55	
- the ability to write the numerals 0-9	Reads and writes numerals through 999	242, 246	45, 75	55, 56, 86, 87, 98	
= = = = =					

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	COMPUTATIONAL SKILLS				
	Addition with regrouping (carrying) from one's to ten's place	181, 183, 186, 187, 195, 259, 273, 305		182, 184, 185, 188, 196-200, 205, 206, 260-263	
	Subtraction with regrouping (borrowing) from ten's to one's place	189, 191, 207, 265		190, 192, 193, 194, 208-211, 213, 214, 266-268	
	Addition with regrouping (carrying) from ten's to hundred's place	273, 307, 80		274-279, 308, 309, 311	81
	Subtraction with regrouping (borrowing) from hundreds to ten's place	281, 313, 315	82	282-286, 314, 316, 317, 318	83
	Addition with three or more addends, two and three digit numerals	201		202, 203, 204, 253, 254, 264, 310, 312	
	MATHEMATICAL UNDERSTANDINGS				
	Pupils should have:				
	- an understanding of the meaning of addition and subtraction			212	93, 103
	Addition is commutative				7, 8, 9, 21, 37, 105
	Addition is associative				50, 51, 77, 101, 111

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	COMPUTATIONAL SKILLS				
	* Basic multiplication facts through 5 x 5	325, 326, 327, 329, 331, 333, 337, 338, 341, 342, 353, 355	113, 114 132	328, 330, 332, 334, 335, 336, 339, 340, 343, 344, 349, 350, 351, 352, 354, 356	
Pupils should have experiences with	* Basic division facts whose dividends are 25 or less such as $3+3 = 6$, $5+5 = 15$	357, 359	115, 133 362, 363, 364	358, 360, 362, 363, 364	
- recognition of equivalent sets					
- counting by twos, fives, and tens					
- using a number line					
- the addition of several like addends such as $3+3 = 6$, $5+5 = 15$					
- subtraction					
	MATHEMATICAL UNDERSTANDINGS				
	* Multiplication is commutative	347	348, 366		
	* Multiplication and division are inverse operations	357	116, 133, 142	361, 365, 366	
	* Multiplication is repeated addition	331, 342		332, 346	
	* Division is repeated subtraction	359			
	* Function of one as a factor in multiplication	345		346	
	* Function of one as a divisor in division	361			
FUNDAMENTAL OPERATIONS					

* OPTIONAL TOPICS FOR
THIS GRADE

GRADE A2

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have classroom experiences involving measurement.	MATHEMATICAL UNDERSTANDINGS Measurement: quantity Measurement: time Measurement: linear Measurement: calendar Measurement: temperature Money values	94		96	
	MATHEMATICAL UNDERSTANDINGS - Recognition of familiar shapes	297, 299		135	
		129		221-240	85, 95, 112
	Pupils should be familiar with the geometric terms - rectangle, square, triangle, circle.			84, 130	

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension		
		BASIC	SUPPL.#1	BASIC	SUPPL.#1	
Pupils should have experiences with:	MATHEMATICAL UNDERSTANDINGS					
<ul style="list-style-type: none"> - using ones, tens and hundreds to describe the value of a number - counting with emphasis on the repetitive patterns of the numbers - recognizing that a fraction represents a part of something concrete materials (place-value chart) to develop the meaning of each number 	The meaning of whole numbers 0-999		41, 79	4, 5, 6, 7, 36, 37, 86, 87, 129-132		
	Place value in ten's and hundred's place			40, 78	4, 5, 85, 86, 87	
	Expanded notation to rename numbers 11-999			41, 42, 80, 81		
	A number has many names				1-3, 39 121	
	The meaning of fractional numbers			51, 52, 105-111	123-125	
	* The meaning of Roman Numerals I-XII			134		
	MATHEMATICAL SKILLS					
Pupils should have experiences with:	NUMBER SYSTEMS AND NUMERATION SYSTEMS			129	2, 6, 7, 38, 133	
<ul style="list-style-type: none"> - writing the numerals 0-9 - writing the numerals 0-100 in sequential order - counting by ones in partial sequences 	Reads and writes numerals through 999			135	* Reads and writes Roman numerals through XII	

* OPTIONAL TOPICS
FOR THIS GRADE

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.#1	BASIC	SUPPL.#1 SUPPL.#2
Pupils should have experiences with <ul style="list-style-type: none"> - renaming numbers using expanded notation - adding and subtracting numbers without regrouping (carrying) 	COMPUTATIONAL SKILLS				
	Mastery of basic addition facts			1, 2, 11, 8, 9, 10, 5, 6, 11, 18, 19, 20, 11, 12, 14, 12, 13, 21, 24, 25, 27, 34, 39, 16, 28, 30, 31, 32 40, 47, 48 42, 43, 53	
	Mastery of basic subtraction facts			5, 6, 18, 15, 16- 30, 31 21, 34, 39, 40, 47, 48	16
	Addition without regrouping or carrying			13, 43, 30-32, 44, 82, 42-45, 83 59, 60, 63, 74	
	Addition with regrouping (carrying)			53, 54, 89-97, 55, 56, 112, 88, 89, 121, 90, 91, 124 92, 93, 102, 103	70, 71
	Subtraction without regrouping (borrowing)			16, 45, 30-32, 84, 85 42-45, 74, 123	
	Subtraction with regrouping (borrowing)			142-146 57, 58, 59, 94, 95, 96, 97, 98, 107, 108, 109	72, 73

FUNDAMENTAL OPERATIONS

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension		
		BASIC	SUPPL. #1	BASIC	SUPPL.#1	SUPPL.#2
Pupils should have: <ul style="list-style-type: none"> - an understanding of the meaning of addition and subtraction - experiences in reading and writing mathematical sentences 	<p>MATHEMATICAL UNDERSTANDINGS</p> <ul style="list-style-type: none"> Function of zero as an addend in addition Function of zero as an addend in subtraction An application of the commutative and associative principles of addition can simplify addition Addition and subtraction are inverse operations 			1, 9, 10	28, 61, 62	70

Prerequisites	Skills and Understandings	Introduction				Review and/or Extension
		BASIC	SUPPL.#1	SUPPL.#2	BASIC	
Pupils should have experiences with:	COMPUTATIONAL SKILLS					
- recognition of equivalent sets	Basic multiplication facts through 5x5	121, 122, 123, 125, 127, 129	171-173	20, 21, 22, 23	124, 126, 128, 130, 131, 132	29, 31
- counting by twos, fives, and tens	* Basic multiplication facts beyond 5x5 and through 9x9	139-148, 153-160, 165, 174, 176, 178, 180	202-203		149, 150 161, 162 163, 164 166, 167 168, 169 175, 177 179, 181 182, 183	25, 32, 37, 46 52
- using a number line						
- the addition of several like addends such as $6+6 = 12$ and $3+3+3 = 12$						
= = = = =						
Pupils should have:	Basic division facts whose dividends are twenty-five or less and are products of basic multiplication facts	134, 135	176-179, 208		136, 138	
- an understanding of the meaning of multiplication and division experiences with mathematical sentences	* Basic division facts whose dividends are eighty one or less and are products of basic multiplication facts	170-171 173, 185	199-200, 202-203, 209		186, 187	33, 34, 37
= = = = =	MATHEMATICAL UNDERSTANDINGS					
	Multiplication is commutative.	131	173			
	*Multiplication is distributive	138-143 145, 147 153-155 157, 159 174, 176 178, 180	202-203			
	Function of zero as a factor in multiplication	132, 149				149
	Function of one as a factor in multiplication	132, 149 161-162	174			149

*OPTIONAL TOPICS FOR THIS GRADE

Prerequisites	Skills and Understandings	Introduction			Review and/or Extension		
		BASIC	SUPPL.#1	SUPPL.#2	BASIC	SUPPL.#1	SUPPL.#2
	MATHEMATICAL UNDERSTANDINGS (Cont.)						
	Multiplication and division as inverse operations	134	176-178 181				
	Division as repeated subtraction	135					
	MATHEMATICAL UNDERSTANDINGS						
	Measurement: time				54-55		
	Measurement: calendar				56		
	Measurement: linear	74, 77	76, 105- 108		103-104		
	Measurement: liquid	34					
	Measurement: weight						
	Money values				77, 78		
	COMPUTATIONAL SKILLS					37-39	
	Measurement: liquid	35, 36					
	Measurement: linear	68-73, 75					
	Money values				79-82, 125, 126		
	Measurement: time				137		

MEASUREMENT

GRADE B3

Prerequisites	Skills and Understandings	Introduction			Review and/or Extension		
		BASIC	SUPPL.#1	SUPPL.#2	BASIC	SUPPL.#1	SUPPL.#2
MATHEMATICAL UNDERSTANDINGS	Recognition and description of familiar figures	189-196					
Pupils should be aware of geometric figures, such as circle, triangle, square, rectangle.	GEOMETRY						

REFERENCE CHARTS, GRADE A3

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.#1	SUPPL.#2	BASIC
Pupils should have - experiences with place value through hundred's place - experiences in counting to see the sequential order of the number names - experiences in renaming numbers using expanded notation - experiences in finding parts of a whole or of a set	MATHEMATICAL UNDERSTANDINGS The meaning of whole numbers through 9999 * 10,000 - 999999 * 1,000,000 Place value in the ten's and hundred's place Place value in the thousand's place * Place value in the million's place Expanded notation to rename numerals through 9999 Fractional numbers as parts of a whole Fractional numbers as parts of a set	287, 288 298 302	216 217	130-132, 216,217 288,295, 298	271
		166-167, 250	193- 198, 201	193- 198, 201	202
		109-111, 168, 186- 187,	251	35, 87- 91, 101, 123, 124, 125	100, 102
	MATHEMATICAL SKILLS Reads and writes numerals through 9999 * 10,000 - 999999 * 1,000,000	133	133	39, 128	
		298, 299	218, 296		
		302, 303			

NUMBER SYSTEMS AND NUMERATION SYSTEMS

*** OPTIONAL TOPICS FOR THIS GRADE**

Prerequisites	Skills and Understandings	Introduction				Review and/or Extension	
		BASIC	SUPPL. #1	BASIC	SUPPL. #1	SUPPL. #2	
Pupils should have:	COMPUTATIONAL SKILLS Basic multiplication facts through 9×9					8, 9, 10, 21, 22, 23, 25, 26, 29, 48- 50, 52	
- experiences with counting to 100 by twos, threes, fours, and fives						31-34	
- experiences with 10 as a factor in multiplication	Basic division facts whose dividends are 81 or less and are products of basic facts						
- subtraction	Multiplication algorithm without regrouping	240-243, 248	210, 227	306, 307, 308, 318	228	46-47, 66, 67	
- an understanding of place value	Multiplication algorithm with regrouping	244, 250	212-213, 229-231	245, 246, 251, 252-	275		
				253, 261, 309-317, 319-320			
	Division algorithm, no remainders	254, 321, 324, 326	238-243	255-259, 260, 322, 323, 325, 327	276, 277	68, 69	
	= = = = =						
	Pupils should have an understanding of the meaning of multiplication and division.					18	
	MATHEMATICAL UNDERSTANDINGS					57	
	Multiplication is commutative					61	
	Multiplication is associative	248					
	Multiplication is distributive			202-203			
	Multiplication and division are inverse operations					199, 200,	40
	Function of one as a factor in multiplication and division					246	
	Function of zero as a factor in multiplication						

FUNDAMENTAL OPERATIONS

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.#1	BASIC	SUPPL.#1
	MATHEMATICAL UNDERSTANDINGS				
	Recognition and properties of familiar forms		189-196, 254-257		
	MATHEMATICAL UNDERSTANDINGS				
	Measurement: linear		224, 264- 265		
	Measurement: liquid			220	
	Measurement: temperature		222-223		
	Measurement: time			225-230, 236, 237	
	Measurement: calendar			223-224	
	Money values			264-265, 268, 270	
	COMPUTATIONAL SKILLS				
	Measurement: time		231-233, 238		86, 87
	Measurement: linear				
	Measurement: liquid			221	
	Money values		232, 244	266-267, 269, 271- 286	74-76, 82, 83
	MEASUREMENT				
	Pupils should be familiar with the four fundamental operations.				
	Pupils should be familiar with the standard units used in measurement.				

REFERENCE CHARTS, GRADE B4

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have:	MATHEMATICAL UNDERSTANDINGS				
- an understanding of place value through thousand's place	The meaning of whole numbers through 1,000,000			11, 12, 34, 78, 79, 81	
- experiences in counting and reading larger numbers	Place value in ten's, hundred's, thousand's and million's place			12, 78, 80, 81	
- experiences in grouping sets of ten	Expanded notation to rename numbers through 10,000			35, 79, 80, 81	
- experiences in finding parts of a whole and parts of a set	The meaning of fractional numbers including equivalent fractions			86-92	37, 40, 41, 42, 43, 44, 46, 47, 54, 55
- experiences with the number line	The decimal system of numeration is built upon a grouping factor of 10 and has a repetitive order to the numerals in each place value				
Pupils should be able to read and write numerals through 1000.	MATHEMATICAL SKILLS				
	Reads and writes whole numbers through 10,000			11, 12, 13	
	Reads and writes fractional numbers			86-92	
	Reads and writes numerals to express money values			18	
	Reads and writes Roman numerals through C			26-28	

NUMBER SYSTEMS AND NUMERATION SYSTEMS

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should know:	COMPUTATIONAL SKILLS				
- the basic addition and subtraction facts	Addition algorithm without regrouping (carrying)	14, 15	1, 2, 15		
- pupils should be familiar with renaming numbers using place value	Addition algorithm with regrouping (carrying)	36-39, 53	3, 4, 5		
= = = = =	Subtraction algorithm without regrouping (borrowing)	14, 15			
= = = = =	Subtraction algorithm with regrouping (borrowing)	36-39	18		
Pupils should be familiar with the meaning of addition and subtraction.	MATHEMATICAL UNDERSTANDINGS				
	Addition is commutative	2, 5		23, 24, 52	
	Addition is associative			2, 3, 4,	
	Addition and subtraction are inverse operations			5, 44	
	Zero is the identity element for addition and subtraction				
	COMPUTATIONAL SKILLS				
Pupils should be familiar with:	Mastery of basic multiplication facts through 9×9	58-66, 93, 97, 98, 101, 102, 105, 110, 113, 122	6, 7, 10, 11, 12, 28, 39		
- basic multiplication and division facts				58-66, 93, 97, 98, 101, 102, 110, 113	
- renaming numbers using place value					70, 71, 72,
- reading and writing numerals using dollar-and-cents notation					94, 123,
- multiplication involving one-digit multiplier without multiples of 10 and 100 as a factor					124, 150,
- subtractive division					154

FUNDAMENTAL OPERATIONS

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	COMPUTATIONAL SKILLS (Cont.)				
	Multiplication algorithm with a one-digit multiplier with regrouping (carrying)			73, 93, 103, 107, 111, 125, 126, 151-152	
	Multiplication algorithm involving dollars and cents			96, 100, 101, 124- 126, 152, 153	
	Division algorithm in which the divisor is a one-digit numeral, no remainders	75		94, 99, 103, 107, 111	
	Division algorithm, one-digit divisors with remainders	131-134		135, 136, 155-163	
	Division algorithm involving dollars and cents	164-165		166-167	
	= = = = =	MATHEMATICAL UNDERSTANDINGS			
	Pupils should have:				
	- an understanding of the meaning of multiplication and division				
	- experiences in reading and writing mathematical sentences				
	Function of zero in multiplication	153			
	One is the identity element in multiplication			62	
	One is the identity element in division			62	

FUNDAMENTAL OPERATIONS

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	MATHEMATICAL UNDERSTANDINGS (Cont.)				
FUND. OPER.	Multiplication and division are inverse operations			59, 60, 61, 66, 98, 105, 168	
GEOMETRY	Multiplication is distributive			95, 106, 103, 110	21, 22, 23, 24, 25, 28
	MATHEMATICAL UNDERSTANDINGS Recognition and identification of common geometric shapes				
PUPILS	Pupils should be able to identify geometric figures such as a circle, square, rectangle, and a triangle.				
	MATHEMATICAL UNDERSTANDINGS				
	Money values			17, 55, 56	
	Measurement: linear			30, 117-119	
	Measurement: weight			32, 33, 146	
	Measurement: temperature			142-143	
	Measurement: liquid			144-145	
	COMPUTATIONAL SKILLS				
	Measurement: linear			31, 120	
	Money values				19, 20, 42-43, 77, 164-167
	Measurement: weight				121

REFERENCE CHARTS, GRADE A4

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have: - an understanding of place value through million's place - experience with the number line - experiences which involve counting using larger numbers - an understanding of the repetitive use of the numbers in a sequence	MATHEMATICAL UNDERSTANDINGS The meaning of whole numbers through 100,000,000 Place value through one hundred million's place The meaning of fractional numbers Fractional numbers have many names (equivalent fractions)			262, 263, 264-265, 267 264-265	
= = = = = Pupils should be able to read and write numerals through 999,999.	MATHEMATICAL SKILLS Reads and writes numerals through 999,999,999 Reads and writes fractional numerals			232, 233, 234 236-239	46 235, 236, 237, 245 41, 42, 43, 44, 45, 65
Pupils should be familiar with: - the basic addition and subtraction facts - the renaming of numbers using place-value notation	COMPUTATIONAL SKILLS Addition algorithm, with and without regrouping (carrying) Subtraction algorithm with and without regrouping (borrowing) Addition of fractional numbers with like denominators, sums two or less Subtraction of fractional numbers with like denominators			179, 256 179, 256 240-241, 242, 243 244, 246, 249 64, 81	4, 36, 80 232-233, 235, 236-239 262, 263, 264- 265, 266, 240-241, 242, 243 64, 81
= = = = = Pupils should understand the meaning of addition and subtraction.	FUNDAMENTAL OPERATIONS MATHEMATICAL UNDERSTANDINGS Addition of whole numbers and fractional numbers is commutative				

	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Prerequisites	MATHEMATICAL UNDERSTANDINGS (Cont.)				
Pupils should have experiences in reading and writing mathematical sentences.	Addition of whole numbers is associative				
	Addition and subtraction are inverse operations for whole numbers and fractional numbers	247, 248			
	Zero is the identity element for addition and subtraction				
	COMPUTATIONAL SKILLS				
	Multiplication algorithm, one-digit multipliers with and without regrouping (carrying)	181, 203, 204			
	Division algorithm, one-digit divisors	181, 205, 206		82, 83, 84, 85, 92, 94, 98	
	Multiplication algorithm, two-digit multipliers with and without regrouping (carrying)	207, 208, 209, 210, 211		212, 213, 215, 216-217, 257	
	Division algorithm, two-digit divisors	221-224, 226, 227		225, 227, 228, 257	
	= = = = =	MATHEMATICAL UNDERSTANDINGS		215	
	Pupils should be familiar with the meaning of multiplication and division.				
	Pupils should have experiences in reading and writing mathematical sentences.				
	FUNDAMENTAL OPERATIONS				

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should be able to describe geometric figures and shapes that are found in the everyday world.	MATHEMATICAL UNDERSTANDINGS The meaning of points, lines, and line segments The meaning of rays and angles Recognition of familiar geometric shapes and forms Recognition of solid figures	184-187 188-189 190-194 195			
Geometry	MATHEMATICAL UNDERSTANDINGS Measurement: time Measurement: calendar Measurement: weight Measurement: linear			173, 174, 268-269 175-176 178 252-255	
Pupils should be familiar with the standard units used in measurement.	=====			=====	=====
	COMPUTATIONAL SKILLS Money values Measurement: time Measurement: temperature Measurement: linear			183, 214, 229, 258-259 268-269 276 277	
	MEASUREMENT Pupils should have: - an understanding of the operations needed for computation - an understanding of the standard units used in measurement				

REFERENCE CHARTS, GRADE B5

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should have:	MATHEMATICAL UNDERSTANDINGS				
- experiences in renaming numbers using place-value notation	The meaning of whole numbers through millions			1-7, 131	
- an understanding of place value through millions	Place value through hundred million's place			1, 3, 4-7, 131, 132-133	
- experiences with the number line	The meaning of fractional numbers	103, 104	96, 97		
- an understanding of the meaning of fractional numbers	Fractional numbers have many names (equivalent fractions)		98, 99-102		
= = = = =	The meaning of the decimal system of numeration (grouping principle)		5-6, 132-133		
= = = = =	The meaning of positional and non-positional numeration systems		9-10		
Pupils should :	MATHEMATICAL SKILLS				
- be able to read and write numbers through 999,999	Reads and writes numerals through 999,999 using period groupings		1, 2, 3-7, 131		
- be familiar with numbers that are multiples of 10, 100, and 1000	Rounds numbers "up" and "down"	134-135			
Pupils should :	COMPUTATIONAL SKILLS			96, 97, 105	
- know all the basic addition and subtraction facts	Mastery of the addition algorithm for whole numbers without using "crutches"		12-19	8, 12	
- be familiar with the use of regrouping in addition and subtraction	Renaming of addends to simplify addition				
NUMBER SYSTEMS AND NUMERATION SYSTEMS					
FOUND. OPER.					

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should:	COMPUTATIONAL SKILLS (Cont.)			22-25, 27-30	
- be familiar with renaming numbers using place-value notation in identifying fractional numbers on a number line	Mastery of the subtraction algorithm for whole numbers without using "crutches"				
- have experiences in identifying fractional numbers on a number line	Addition of fractional numbers with like denominators	111, 113		106-109, 114, 115, 116	
- know that a fractional number can be renamed in many ways	Subtraction of fractional numbers with like denominators	122-123, 125-127		117-120, 124, 128, 129, 130	
= = = = =	= = = = = MATHEMATICAL UNDERSTANDINGS				
= = = = =	Addition with whole numbers or fractional numbers is commutative and associative			12, 13, 35, 110, 112	
= = = = =	Pupils should understand that the operations of addition and subtraction are alike for all numbers.				
= = = = =	Pupils should be familiar with mathematical sentences and equations.				
FUNDAMENTAL OPERATIONS					
Pupils should know:	COMPUTATIONAL SKILLS				
- the basic facts of multiplication and division	Multiplication algorithm, two-digit multipliers with and without regrouping (carrying)	45-49		37, 43, 44, 45	
- how to multiply with a one-digit multiplier	Division algorithm, one-digit divisors	51-63		46, 47	
- how to divide by a one-digit divisor	Division algorithm, two-digit divisors			68-75, 81-85, 52, 53 91, 92, 93, 94, 95, 138	

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	COMPUTATIONAL SKILLS (Cont.)				
	Estimating quotients by comparing numbers	52-57, 66, 71, 76, 79, 89		77, 80, 90, 136, 137, 138	
= = = = =	MATHEMATICAL UNDERSTANDINGS				
Pupils should:	<ul style="list-style-type: none"> - understand the meaning of multiplication and division - be familiar with the terms commutative, associative, and distributive - be familiar with reading and writing mathematical sentences 	<ul style="list-style-type: none"> Multiplication is commutative, associative, and distributive Multiplication and division are inverse operations One is the identity element for multiplication and division Function of zero in multiplication Division is distributive in certain instances 	<ul style="list-style-type: none"> 37, 38, 40, 9, 42 41 50, 51 39, 51 40 	<ul style="list-style-type: none"> 28, 29, 33, 54 32 32 32 	<ul style="list-style-type: none"> 33, 50 54
	FUNDAMENTAL OPERATIONS				
	MEASUREMENT				
	COMPUTATIONAL SKILLS				
	Pupils should:	<ul style="list-style-type: none"> - be familiar with the standard units of measurement - have an understanding of the operations needed for computation 			
	Measurement: time				
	Measurement: calendar				
	Measurement: linear				
	Measurement: liquid				
	Measurement: weight				
	Measurement: quantity				
	Money values				
		8, 20, 31, 44, 64, 78, 86		26, 27, 30, 32, 33, 54	

REFERENCE CHARTS, GRADE A5

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should be familiar with the meaning of the base ten system of numeration, including the renaming of numbers using place-value notation and the use of ten as a factor for grouping.	MATHEMATICAL UNDERSTANDINGS The meaning of the system of whole numbers The meaning of fractional numbers The meaning of the decimal system of numeration * The meaning of the base five system of numeration The meaning of decimals as fractional numbers Place value extended to tenths, hundredths and thousandths =====	193-195 236-241 261-269 243 237, 238, 240	190, 283, 298, 311, 312 178-181, 189, 196 246 72, 73	190, 205, 283, 298 244-246, 308 270-276 277	Review and/or Extension
Pupils should be aware of the existence of the various number systems and their names.	MATHEMATICAL SKILLS Classifies numbers as whole, fractional, decimal, odd, even, prime, composite Reads and writes numerals grouped in periods Reads and writes decimals through thousandths Expresses ratios as fractions * Reads and writes numerals in base five notation	236-241, 242 270-276 277	190, 205, 283, 298 244-246, 308 263-269		
	* OPTIONAL TOPICS FOR THIS GRADE				

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension
		BASIC	SUPPL.	
Pupils should have:	COMPUTATIONAL SKILLS			
- complete mastery of the basic addition and subtraction facts	Mastery of the addition algorithm with whole numbers without using "crutches"		152, 284, 285, 313	6, 7, 8
- an understanding of place-value	Mastery of the subtraction algorithm with whole numbers without using "crutches"		153, 286, 313	7
- facility in addition and subtraction involving regrouping	Addition of fractions with unlike denominators	182, 183	17, 54-55, 59	184, 187, 188, 197, 302, 303, 304
	Subtraction of fractions with unlike denominators	182, 183, 185	17, 54-55, 59	184, 186, 187, 188, 198, 302, 303, 304
	Addition of decimal fractions without regrouping (carrying)	250-251	68	
	Subtraction of decimal fractions without regrouping (borrowing)	252	68	
	Addition of decimal fractions with regrouping (carrying)	248-249, 253		255, 310
	Subtraction of decimal fractions with regrouping (borrowing)	254	71	255, 310
	MATHEMATICAL UNDERSTANDINGS			
	Addition of whole numbers, fractional numbers, and decimal fractions is commutative and associative			
	Addition and subtraction are inverse operations			

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should be familiar with: - multiplication by one-digit multipliers - division by one-digit divisors	COMPUTATIONAL SKILLS Multiplication algorism, two-digit multipliers Multiplication algorism, three-digit multipliers Estimates products and dividends Division algorism, two-digit divisors Division algorism, remainders expressed as fractional numbers			170, 288 45	37, 43, 44, 45
	= = = = =			292, 293, 321, 322,	76-79
				171, 191, 291, 292, 293, 294	
		234-235	75, 76		
		= = = = =	MATHEMATICAL UNDERSTANDINGS		
			Multiplication is commutative, associative, and distributive		
			Division is not commutative or associative		
			Division may be distributive		
			Multiplication and division are inverse operations		
			One is the identity element for multiplication and division		
GEOMETRY	Pupils should be able to describe familiar geometric shapes and figures, using formal geometric terms.		MATHEMATICAL UNDERSTANDINGS		
	The meaning of point, line, and line segment		213-215		

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
MATHEMATICAL UNDERSTANDINGS (Cont.)					
The meaning of plane figures	216-217				
The meaning of rays and angles		218		100, 102, 103	
The meaning of closed plane figures			219-221, 223-224	100, 101, 125, 126	
The meaning of solid geometric forms		222, 226			
COMPUTATIONAL SKILLS					
Measurement: time	162, 164-166			28, 29, 54, 66	
Measurement: linear	154-155			256, 257, 258, 259	32, 63, 87, 88, 89
Measurement: liquid	160				32, 67
Measurement: weight	167				33
Measurement: area	175			176	78
MATHEMATICAL UNDERSTANDINGS					
Measurement: time					161
Measurement: calendar					163
Measurement: linear	142-150				
Measurement: liquid				156-158	
Measurement: temperature				168-169	
Measurement: area	172-174				88
GEOMETRY			MEASUREMENT		

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension
		BASIC	SUPPL.	
Pupils should be familiar with the meaning of the base ten system of numeration, including the renaming of numbers using place-value notation and the use of ten as a factor for grouping.	MATHEMATICAL UNDERSTANDINGS The meaning of whole numbers through billions Exponential notation for whole numbers Place value through billions The meaning of decimal fractions Place value through hundred thousandths The meaning of fractional numbers The meaning of the base six system of numeration	6, 7 58, 59, 60, 61 4, 5 148-152, 155 149-154 9, 10, 11, 12	4, 5, 6, 7 2-8 4, 5 12	BASIC SUPPL.
	The meaning of the Roman system of numeration The meaning of reciprocal	14	90-95	SUPPL.
	MATHEMATICAL SKILLS Reads and writes numerals through billions Reads and writes numerals in base six notation Uses decimals to rename fractions	2, 3, 5, 63, 101 9-12 148-158	2-8 12	

NUMBER SYSTEMS AND NUMERATION SYSTEMS

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	MATHEMATICAL SKILLS (Cont.)				
Uses exponents to rename numbers	6, 7, 61	58, 59, 60, 8, 63, 101			
Rounds decimal fractions to place value	162-163		164		
Renames ratios as a fraction	124, 125, 126		127, 128		
	COMPUTATIONAL SKILLS				
Pupils should be familiar with:					
- the renaming of numbers using place-value notation	Addition as an operation with an ordered pair of numbers	15	16, 17, 18, 64	22, 39	
- the operations of addition and subtraction	Subtraction as an operation with an ordered pair of numbers	15, 19	18, 20, 64		
- the renaming of fractional numbers in many ways	Addition of fractions with like denominators		48, 49, 50, 51		
- the renaming of decimal fractions in many ways	Addition of fractions with unlike denominators		59, 60, 61, 67, 69		
- regrouping or renaming as used in addition and subtraction	Subtraction of fractions with like denominators		54		
	Subtraction of fractions with unlike denominators		59, 60, 61, 68, 69		
Addition of decimal fractions	158	159, 160, 161			
Subtraction of decimal fractions					

FUNDAMENTAL OPERATIONS

Prerequisites	Skills and Understandings		Introduction		Review and/or Extension	
	BASIC	SUPPL.	BASIC	SUPPL.	BASIC	SUPPL.
MATHEMATICAL UNDERSTANDINGS (Cont.)						
Addition and subtraction are inverse operations			15, 19		22	
Addition with all numbers is commutative	49				40	
Addition with all numbers is associative	49		17		39, 40, 41	
Subtraction is not commutative or associative						
=====						
Pupils should be familiar with:						
- subtractive division						
- mental computations involving multiplication in which one factor is a multiple of 10 or 100						
- renaming fractions						
Multiplication algorism with whole numbers without the use of crutches	29		24, 25, 26, 27, 28, 65		16, 50, 51	
Division algorism with two-digit divisors, whole numbers	113		30, 31, 32-37, 65		17	
Multiplication of fractional numbers by fractional numbers	72, 73, 74		75, 77, 83	83	23, 24, 25, 35	
Multiplication of fractional numbers and whole numbers	76					
Multiplication of mixed fractional numbers	79				80, 81, 82, 83, 84, 166	
Division of a whole number by a fractional number	86, 87		92		32, 35	
=====						

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	COMPUTATIONAL SKILLS (Cont.)				
	Division of fractional numbers using reciprocals	88, 89		90, 91, 93 166	32
	Division of fractional number by a fractional number	88, 89, 103- 105		90-95, 98, 166	32, 35
	MATHEMATICAL UNDERSTANDINGS				
	Pupils should have:	<ul style="list-style-type: none"> - an understanding of the meaning of multiplication and division - experiences in reading and writing mathematical sentences 		<ul style="list-style-type: none"> - Multiplication of all numbers is associative, distributive, and commutative - The product of any number and its reciprocal is always one 	
		One is the identity element for multiplication and division of all numbers		65	
		Multiplication and division are inverse operations		22, 65	
		Division may be expressed as a fraction		18, 19	
		Division may be distributive		65	

FUNDAMENTAL OPERATIONS

GRADE B6

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension		
		BASIC	SUPPL.	BASIC	SUPPL.	
	COMPUTATIONAL SKILLS			130, 131, 134		
	Measurement: time					
	Measurement: calendar			132		
	Measurement: linear			131, 132, 133, 135, 136, 166	62, 63, 64, 65, 66, 67	
	Measurement: liquid			129, 130, 132, 133, 166		
	Measurement: weight			123, 130, 131, 132, 133, 166		
	MATHEMATICAL UNDERSTANDINGS					
	Pupils should have experiences involving the use of standard units of measurement.			116-117		
	The meaning of error of measurement			118-122		

MEASUREMENT

REFERENCE CHARTS, GRADE A6

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Pupils should be familiar with the meaning of the base ten system of numeration, including the renaming of numbers using place-value notation and the use of ten as a factor for grouping.	MATHEMATICAL UNDERSTANDINGS The meaning of whole numbers through billions The meaning of fractional numbers The meaning of decimal fractional numbers The meaning of the positive and negative integers The meaning of per cent	178, 194, 211		178, 194, 2-4, 6	
	262-265			178	38
	239-241			178	5, 7
	242, 243, 244				
Pupils should have experiences with	MATHEMATICAL SKILLS Reads and writes numerals through billions Renames fractional numbers as per cents	178, 194, 197, 198, 202, 203, 204		178, 194, 56, 57, 61	
- reading and writing numerals through millions - renaming various kinds of numbers in many different ways				240-241, 245, 247	
	262-265				
Renames fractions as decimals	190			193, 297	12, 102

NUMBER SYSTEMS AND NUMERATION SYSTEMS

	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
Prerequisites	COMPUTATIONAL SKILLS				
Pupils should be familiar with the operations of addition and subtraction of whole numbers, fractional numbers, and decimal fractions.	Addition with positive and negative integers	266, 267	114	268, 269	115, 121
	* Addition and subtraction with base six numerals	311-312			
	Addition algorism, whole numbers		283		
	Subtraction algorism, whole numbers		283		
	Addition of fractional numbers		285, 286		
	Subtraction of fractional numbers		285, 286		
	Addition of decimal fractional numbers		298, 301	15	
	Subtraction of decimal fractional numbers		298		
	= = = = =				
	MATHEMATICAL UNDERSTANDINGS				
	Addition of all numbers is commutative and associative				22, 23, 45, 109, 110
	Addition and subtraction are inverse operations				22, 23
	COMPUTATIONAL SKILLS				
	Multiplication algorism, whole numbers		259, 284	106, 107	

* OPTIONAL TOPICS FOR THIS GRADE

Prerequisites	Skills and Understandings	Introduction		Review and/or Extension	
		BASIC	SUPPL.	BASIC	SUPPL.
	COMPUTATIONAL SKILLS (Cont.)				
Pupils should be familiar with the operations of multiplication and division of whole numbers and fractional numbers.	Division algorithm, whole numbers			191, 208, 260, 284	17
Pupils should be familiar with renaming fractions as decimals.	Multiplication of a whole number by a decimal fraction	170-171		174, 175, 177, 180	
	Multiplication of a decimal fraction by a decimal fraction	172-173, 176		174, 175, 185, 299	16
	Division algorithm, decimal fractions	182-183		184, 186, 187, 192,300	
	Multiplication of fractional numbers			287, 290	24, 35, 118
	Division of fractional numbers			288, 290	24, 35
	MATHEMATICAL UNDERSTANDINGS				
	Multiplication of all numbers is commutative, associative, and distributive			259, 320	18, 19, 20, 43, 44, 45, 46, 47, 112
	Multiplication and division are inverse operations				24, 25, 26
	One is the identity element for multiplication and division				
	Division is not commutative or associative				
	Division may be expressed as a fraction				

GRADE A6

Skills and Understandings	Introduction		Review and/or Extension
	BASIC.	SUPPL.	
MATHEMATICAL UNDERSTANDING			
The meanings of points, lines, line segments, and rays			212-214, 304
The meaning of angle		215	
The meaning of parallel and perpendicular lines	220, 221, 222		
The meaning of planes		216, 235	
The meaning and identification of closed figures		223, 224, 225, 226, 227, 228, 305	
The meaning and identification of solid geometric forms		232-234, 236-237, 270- 271, 272, 273, 274, 277, 278	
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MATHEMATICAL SKILLS			
Reads and measures angles with a protractor	217-219	230, 231, 306	
Uses a compass for geometric constructions		229	
COMPUTATIONAL SKILLS			
Measurement: linear		274, 275, 276, 291, 292, 293, 294, 295, 296, 322	62, 63, 64, 65, 66, 67, 127
Measurement: temperature		264-265	
Measurement: liquid		291, 292, 293, 294	